

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11) **EP 1 056 101 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.11.2000 Bulletin 2000/48

(51) Int. Cl.⁷: **H01F 27/08**, H01F 27/245

(21) Application number: **99307591.0**

(22) Date of filing: **27.09.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Lee, Chea-how**
Youngton-dong, Paldal-gu, Suwon-city (KR)

(30) Priority: **27.05.1999 KR 9919131**

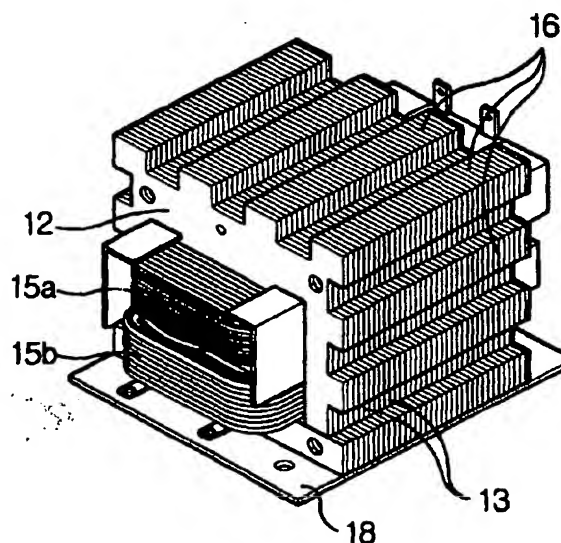
(74) Representative:
Geary, Stuart Lloyd et al
Venner, Shipley & Co.,
20 Little Britain
London EC1A 7DH (GB)

(71) Applicant:
SAMSUNG ELECTRONICS CO., LTD.
Suwon-City, Kyungki-do (KR)

(54) **High-voltage transformer with cooling ribs**

(57) A high-voltage transformer has a laminated core (12). The laminations (13) of the core (12) have projections (17) which together form longitudinal cooling ribs (16).

FIG.3



Description

[0001] The present invention relates to a high-voltage transformer comprising a laminated core and cooling means.

[0002] High-voltage transformers (HVT) are used in microwave oven to step up the mains voltage (110V, 220V or 240V) to a high voltage suitable for driving a magnetron.

[0003] Conventionally, such high-voltage transformers have a laminated core, comprising a plurality of iron laminations arranged side by side, and primary and secondary windings wound on the laminated core. Each iron lamination comprises an E-shaped iron plate and an I-shaped iron plate, joined to the E-shaped plate across the ends of its arms. When an alternate current (AC) is passed through the primary winding, a voltage is induced in the secondary winding. The induced voltage is determined by the turns ratio of the primary and secondary windings.

[0004] During operation, high-voltage transformers generate because of coil resistance, hysteresis core losses, and eddy current losses. Such generated heat is a problem because it causes degradation of insulation. Consequently, heat radiating means has been provided on high-voltage transformers. In KR-A-98-6654, a transformer having cooling fins 3 is described. The fins 3 are formed by plates placed between laminations at predetermined intervals as shown in Figure 1. GB-A-914857 discloses a transformer having asymmetric E-shaped plates 4. Referring to Figure 2, each E-shaped plate 4 has a thick outer arm 4a and a thin outer arm 4b. The laminations are grouped together and the groups are brought together so that the thick arms 4a protrude first on one side of the core and then on the other to form cooling fins 5.

[0005] The transformers described above suffer from complicated assembly processes requiring insertion of fins or arranging groups of laminations in different orientations.

[0006] Embodiments of the present invention will now be described, by way of example, with reference to Figures 3 to 6 of the accompanying drawings, in which: -

Figure 1 is a perspective view of a prior art high-voltage transformer;

Figure 2 is a perspective view of another prior art high-voltage transformer;

Figure 3 is a perspective view of a high voltage transformer according to the present invention;

Figure 4 is a perspective view for showing a lamination from the core of the transformer shown in Figure 3; and

Figures 5 and 6 are perspective views of details of alternative forms of lamination for a transformer according to the present invention.

[0007] Referring to Figures 3 and 4, a high voltage

transformer includes a laminated core 12, primary and secondary windings 15a, 15b, a plurality of longitudinal cooling ribs 16 and a base plate 18 for supporting the high-voltage transformer and fixing it to another member.

[0008] The laminated core 12, as shown in Figure 4, is formed by bringing together a plurality of laminations from E- and I-shaped plates 13a, 13b in the conventional manner. The primary and secondary windings 15a, 15b are mounted about the middle arms 14 of the E-shaped plates 13a.

[0009] The cooling ribs 16 extend perpendicular to the laminations 13 on both sides and the top of the core 12. The cooling ribs 16 are formed as the laminations 13 are brought together by similarly positioned protrusions 17 on the outer peripheries of the E-shaped plates 13a. The protrusions 17 are rectangular in cross-section. However, as shown in Figures 5 and 6, other shapes can be used, e.g. wavy and triangular. Nevertheless, the rectangular form is preferred as it performs best of the illustrated forms.

[0010] It can be seen that a transformer according to the present invention avoids the manufacturing difficulties associated with the prior art transformers described above.

Claims

1. A high-voltage transformer comprising a laminated core (12) and cool means (16), characterised in that the cooling means (16) comprises a plurality of protrusions (17; 17'; 17'') from laminations (13) of the core (12), the protrusions being aligned to form an elongate structure (16) projecting from the core (12) and extending perpendicular to the laminations (13) thereof.
2. A transformer according to claim 1, wherein the cooling means (16) comprises a plurality of elongate structures (16) projecting from the core (12) and extending perpendicular to the laminations (13) thereof, each said structure (16) comprising a plurality of aligned protrusions (17; 17'; 17'') from laminations (13) of the core (12).
3. A transformer according to claim 2, wherein each lamination (13) has a plurality of protrusions (17; 17'; 17'') contributing to respective ones of said elongate structures (16).
4. A transformer according to claim 1, 2 or 3, wherein the cross-section of the or each said elongate structure (16) is rectangular.
5. A high voltage transformer, comprising:

a laminated core formed of a plurality of iron plates which are accumulated one over

another;

first and second windings wound in the laminated core and for converting an input voltage to a predetermined output voltage; and

a plurality of radiation ribs formed in the accumulated direction of the plurality of iron plates on the outer periphery of the laminated core. 5

6. The high voltage transformer as claimed in claim 5, wherein the plurality of radiation ribs are formed as the plurality of iron plates are accumulated, by the accumulation of a plurality of protrusion portions formed along each of the plurality of iron plates. 10

7. The high voltage transformer as claimed in claim 5, wherein the plurality of radiation ribs have cross sections of a rectangular shape in order for the surface area to be maximized. 15

20

25

30

35

40

45

50

55

FIG.1

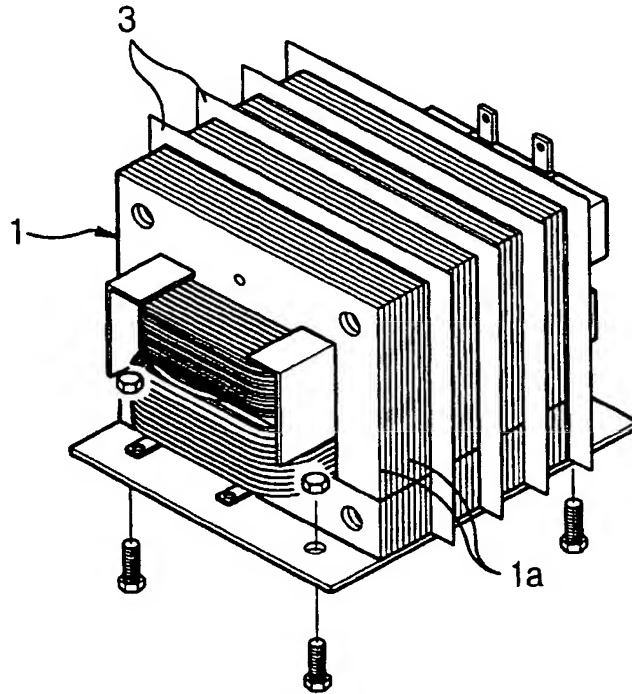


FIG.2

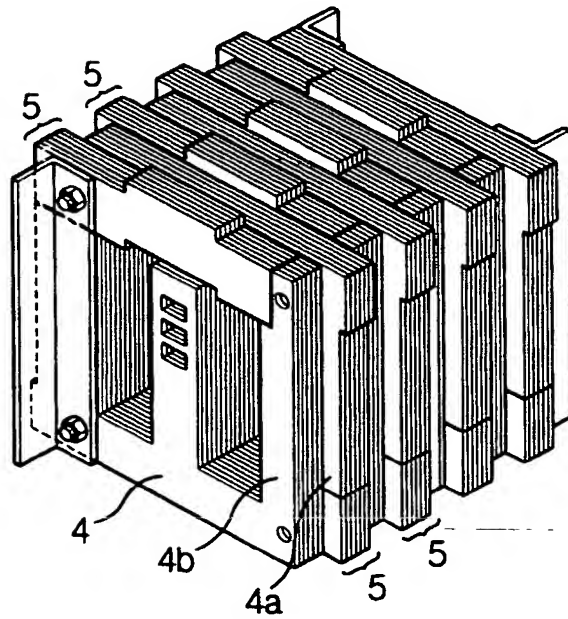


FIG.3

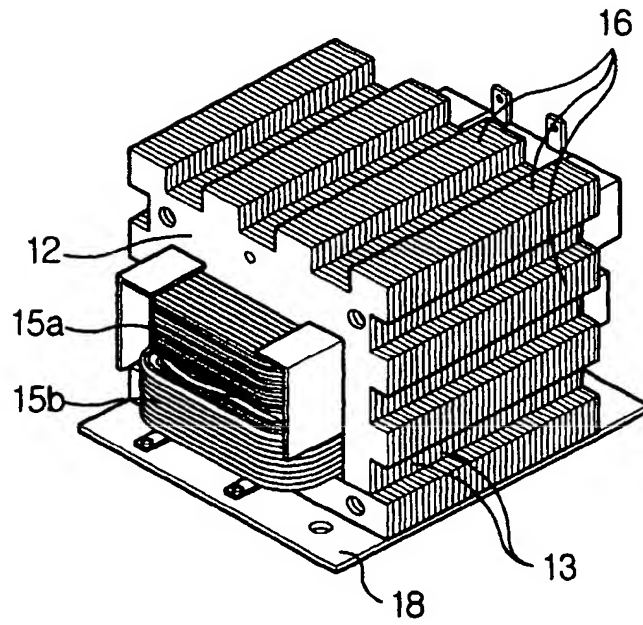


FIG.4

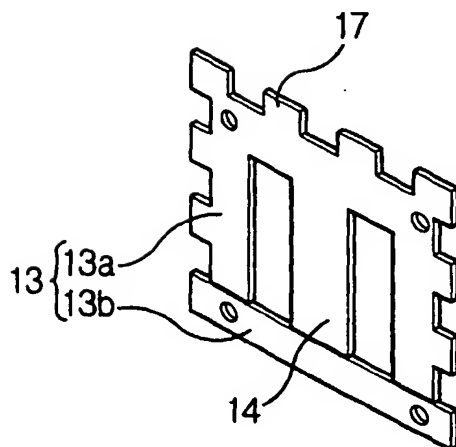


FIG.5

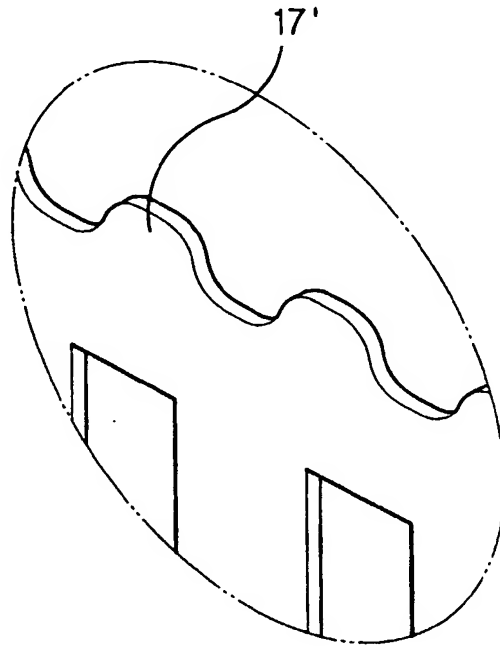
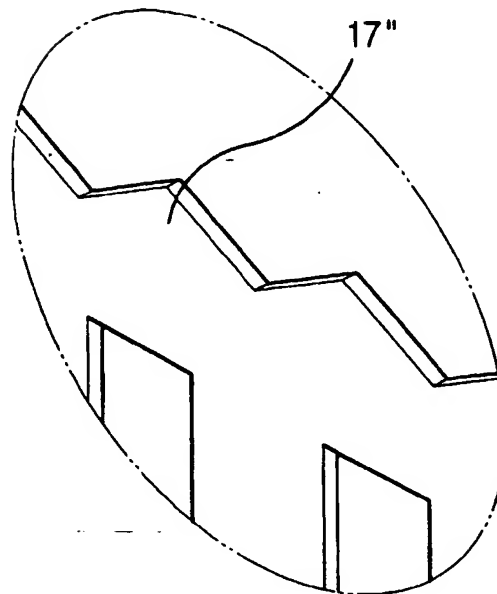
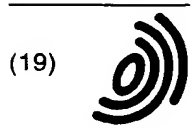


FIG.6





(19)

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 056 101 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
26.09.2001 Bulletin 2001/39

(51) Int Cl.7: **H01F 27/08**, H01F 27/245

(43) Date of publication A2:
29.11.2000 Bulletin 2000/48

(21) Application number: 99307591.0

(22) Date of filing: 27.09.1999

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Lee, Chea-how**
Youngton-dong, Paldal-gu, Suwon-city (KR)

(30) Priority: 27.05.1999 KR 9919131

(74) Representative: **Geary, Stuart Lloyd et al**
Venner, Shipley & Co.,
20 Little Britain
London EC1A 7DH (GB)

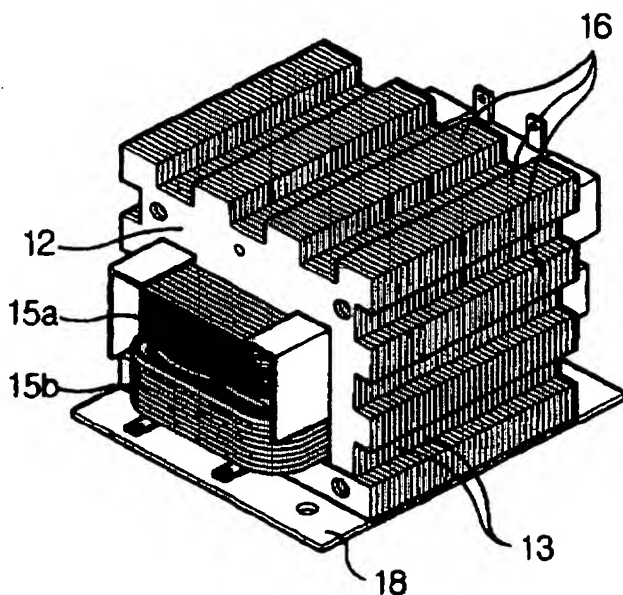
(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**
Suwon-City, Kyungki-do (KR)

(54) **High-voltage transformer with cooling ribs**

(57) A high-voltage transformer has a laminated core (12). The laminations (13) of the core (12) have

projections (17) which together form longitudinal cooling ribs (16).

FIG.3





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 7591

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (In.CI.7)
X	PATENT ABSTRACTS OF JAPAN vol. 005, no. 181 (E-083), 20 November 1981 (1981-11-20) & JP 56 108216 A (CANON INC), 27 August 1981 (1981-08-27) * abstract *	1-7	H01F27/08 H01F27/245
X	US 4 447 795 A (SEFKO JOHN ET AL) 8 May 1984 (1984-05-08) * figure 12 *	1-4	
A	DE 196 45 098 A (VOSSLOH SCHWABE GMBH) 14 May 1998 (1998-05-14)		
A	US 2 827 615 A (GENERAL ELECTRIC COMPANY) 18 March 1958 (1958-03-18)		
A	US 1 876 451 A (TELEFUNKEN) 6 September 1932 (1932-09-06)		
A	GB 671 823 A (BRITISH THOMSON HOUSTON CO LTD) 14 May 1952 (1952-05-14)		
			TECHNICAL FIELDS SEARCHED (In.CI.7)
			H01F
The present search report has been drawn up for all claims			
Place of search: THE HAGUE		Date of completion of the search: 1 August 2001	Examiner: Vanhulle, R
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 B2 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 7591

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

01-08-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 56108216 A	27-08-1981	NONE	
US 4447795 A	08-05-1984	AU 549144 B	16-01-1986
		AU 7791081 A	11-11-1982
		BE 891678 A	05-07-1982
		BR 8108546 A	12-04-1983
		CA 1176324 A	16-10-1984
		ES 508501 D	01-03-1983
		ES 8304701 A	01-06-1983
		FR 2505546 A	12-11-1982
		IN 155990 A	20-04-1985
		JP 57183011 A	11-11-1982
		NO 814020 A	08-11-1982
DE 19645098 A	14-05-1998	NONE	
US 2827615 A	18-03-1958	NONE	
US 1876451 A	06-09-1932	NONE	
GB 671823 A	14-05-1952	NONE	

EPO FORM P0439

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

THIS PAGE BLANK (USPTO)